CASE STUDY ANALYSIS OF THE U.S. AND EU PROPOSALS

Task Final Report

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1. EXECUTIVE SUMMARY

Introduction

The issue of greenhouse gas emissions has been at the forefront of environmental concerns for the past decade. A number of treaties, agreements, and voluntary programs have been proposed to reduce emissions – some of which have been the subject of intense debate and disagreement. Most notable among these proposals has been the Kyoto Protocol. Signed in 1997 by the United States and other industrialized countries, the Kyoto Protocol is a major international treaty imposing binding emission reduction targets on the developed world. However, the U.S. Senate never ratified Kyoto, and the Administration recently announced its intention of dropping out of the international negotiations surrounding the Protocol. Nonetheless, the general scientific consensus, that global warming is a real, significant issue, is not in dispute. The Administration is calling into question only the appropriate response to this issue, while explicitly recognizing the need for *some* response.

Regardless of whether this response takes the form of a domestic voluntary program, an international treaty, or something in between these two extremes, it is likely that it will incorporate "market mechanisms" in some form or other. Most of the various emission reduction responses that have been proposed over the past few years include such mechanisms. The development and implementation of these mechanisms, designed to facilitate low-cost solutions to environmental problems, is part of a broader trend away from the command-and-control regulations of the past, and towards increased flexibility in meeting regulatory requirements. This new market-based approach has worked it way into greenhouse gas emission reduction programs and proposals, using the guidelines provided by the United Nations Framework Convention on Climate Change (UNFCCC), and developed into a new concept: credits for emission reduction projects undertaken beyond a country's borders.

Perhaps the greatest challenge for this new concept is the development of a protocol, or set of protocols, for estimating the emission reductions associated with projects. There is considerable concern among various groups surrounding the accuracy of the emission reduction estimates upon which credits would be awarded. In addition, others, particularly any potential project developer, want protocols that can be implemented within reasonable costs. Nonetheless, all parties generally recognize the need for accuracy of credits and agree on the need for a standard approach or set of procedures for estimating project-level emission reductions. A number of such approaches have been proposed and the purpose of this report is to evaluate some of the key proposals. Specifically, the report presents a series of hypothetical case study analyses designed to test each proposed approach in the context of potential real world projects. The case studies have been selected to cover a broad range of sectors and project types. The goal is to identify the strengths and weaknesses of each approach, and based on the case study analyses, recommendations for improving and refining the different approaches are developed.

Four different approaches are evaluated in this report:

- The approach officially proposed by the U.S. at the recent (COP-6) negotiations surrounding the Kyoto Protocol

- The European Union's "Positive Technology List"

- The U.S. National Energy Technology Laboratory's (NETL) technology matrix concept (the "full" technology matrix)

- A hybrid approach combining elements of the technology matrix with the official U.S. approach (the "hybrid" technology matrix)

The Case Studies and the Methodological Approach

Each case study project is evaluated using each of the above four approaches. The results for each approach are analyzed, compared and contrasted; these critical analyses in turn reveal the strengths and weaknesses of the different approaches in the context of a variety of different project types.

The Four Approaches

The Official U.S. Approach. Although initially proposed during the negotiations on the Kyoto Protocol, the "official" U.S proposal remains relevant (despite the uncertain future of the Protocol) as a potential starting point for any future approach crafted to meet the needs of either a voluntary domestic program, or an international mandatory agreement. It suggests a two-step approach to dealing with additionality and baseline development. In the first step, a project's eligibility for credits is determined through a comparison of the project's emissions with a standard benchmark representing a level of emissions performance that is significantly better than the average for recent, comparable projects. In the second step, the credits to be awarded to qualifying projects would be computed by subtracting the project's emissions from a second benchmark, representing the average emissions of recent, comparable projects.

The EU Positive List. The EU has proposed that only projects based on a "positive list" of safe, environmentally sound, clean technology projects should be able to obtain credits.[1] The proposed positive list is presented in Table ES1.

[1] European Commission, "Outcome of Climate Change Negotiations in Lyon, France, 4-15 September, 2000 (Press Release)," September 1, 2000, http://europa.eu.int/comm/environment/press/bio00172.htm

Table ES-1. The EU's Positive List of Technologies

Main Technology Categories	Individual Technologies
Renewables	Solar
	Wind
	Sustainable Biomass
	Geothermal heat and power
	Small-scale hydropower
	Wave and tidal power
	Ambient heat
	Biogas
Energy Efficiency	Advanced technologies for combined heat and power installations and gas fired power plants
	Significant improvements in existing energy production
	Advanced technologies for, and/or significant improvements in industrial processes, buildings, energy transmission, transportation and distribution
	More efficient and less polluting modes of mass and public transport (passenger and goods) and improvement or substitution of existing vehicles
Demand Side Management	Improvements in residential, commercial, transport and industrial energy consumption.

The Full Technology Matrix. The technology matrix approach, modified and developed by the U.S. Department of Energy's National Energy Technology Laboratory (NETL) consists of a selected list of greenhouse gas abating technologies that correspond with the sustainable development goals of a host country.[2] Additionality and baseline determination, under this approach, take place in two stages. First, a technology is subjected to an additionality test to determine whether it should be included in the matrix. This test would be based on factors such as the commercial viability and market penetration of the candidate technology. The test will be designed to ensure that only advanced, non-commercial technologies qualify for inclusion in the matrix

Second, a stipulated benchmark will be developed for each approved technology based on the emissions performance of a selected group of counterfactual technologies. To qualify for credits, project developers would simply demonstrate that the proposed project technology is included in the matrix. The stipulated benchmark from the matrix would then be used to calculate the project's emission reductions.

The Hybrid Technology Matrix. The hybrid technology matrix approach is based on a combination of the full technology matrix's additionality test and the second step of the official U.S. proposal for baseline development.

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[2] As sustainable development criteria are likely to vary among countries most examples of the modified technology matrix are anticipated to be country-specific.

The Case Studies

Each of the above-described approaches is applied to forty case studies. In developing the case studies, the objective has been to cover a variety of plausible projects in an attempt to test the four approaches against a full spectrum of situations likely to arise under a future carbon mitigation regime.

Table ES2 lists the case studies. In this table, the case studies are organized by sector with eleven case studies developed for the electricity sector, thirteen for the industrial sector, nine for the transportation sector, three for the residential sector, two for the commercial sector and two for the forestry sector. Because the electricity sector has received more attention in the development of the technology matrix and the U.S. approach, we have shifted the emphasis somewhat towards other sectors. The goal is to test the methodologies in applications, which are plausible under future carbon mitigation regimes. All of the case studies identified in Table ES2 are fictitious. In addition, most (although not all) of the "data" utilized in the case studies are fictitious. The use of hypothetical projects, with fictitious data, significantly reduced the amount of time required to develop each case study. This in turn enabled the development of a large number and variety of case studies—a key objective of the analysis, given the desire to test the methodologies under the full spectrum of plausible scenarios. Had an attempt been made to obtain actual data for the case studies, the data collection effort would have drastically reduced the amount of time available for case study development and analysis. Furthermore, in many cases it would likely have proved impossible to obtain the required data.

Table ES-2. The Case Studies

Sector	Project ID #	Country	Project Title
Electricity	ES1	India	IGCC Power Plant
	ES2	India	Heat Rate Improvement
	ES3	India	Fuel Switching
	ES4	India	Natural Gas Combine Cycle
	ES5	India	Gas Turbine Plant
	ES6	India	Wind Power
	ES7	Kazakhstan	IGCC in Kazakhstan
	ES8	Tajikistan	Hydropower
	ES9	India	Distributed Generation: Fuel Cells
	ES10	China	Transmission Capacity Expansion
	ES11	India	Carbon Sequestration for IGCC Plant
Industrial	IS1	Azerbaijan	Installation of District Heating System
	IS2	Kazakhstan	Cogeneration at Food Processing Plant
	IS3	Argentina	Variable Frequency Drives
	IS4	Brazil	Retrofit of Energy Efficient Motors
	IS5	China	Coke Oven Underfiring Rate Improvement
	IS6	Tajikistan	PFC Reductions at Aluminum Plant
	IS7	China	Coal Ash Utilization
	IS8	Chile	Building Insulation Improvement
	IS9	Jordan	Highly Efficient Fertilizer Complex
	IS10	China	Industrial Boiler Shutdown
	IS11	South Africa	Coal Mine Methane Recovery

	IS12	Argentina	Landfill Gas Flaring
	IS13	Kazakhstan	Recovery of Associated Natural Gas
Transportation	TS1	India	Dedicated CNG Taxis
	TS2	India	New Gasoline-Fueled Taxis
	TS3	China	Aluminum Rail Cars for Efficient Coal Transport
	TS4	S. Africa	Clean Diesel in Transit Buses
	TS5	Mexico	Electric Vehicles in Mexico City
	TS6	Thailand	Smart Toll System
	TS7	Ukraine	46 New Conventional Diesel Buses
	TS8	India	New Two-Wheelers
	TS9	Brazil	Improving Road Infrastructure
Land Use	LU1	Mexico	Forest Protection and Management
	LU2	Russian Federation	Afforestation of Marginal Agricultural Land in Russia
Residential	RS1	South Africa	Construction of Energy-Efficient Homes in South Africa
	RS2	Mexico	Sale of High-Efficiency Light Bulbs for Homes
	RS3	Russian Federation	Energy Efficiency of Seven Apartment Buildings
Commercial	CS1	Philippines	Energy Efficiency and Conservation Measures in Commercial Buildings
	CS2	Indonesia	Motor Replacement Project in Commercial Office Buildings in Jakarta

Each of the case studies listed in Table ES2 is analyzed using each of the four emission credit estimation approaches. Under each approach, a determination is made to whether or not the project should qualify for credits or be rejected as a free rider. Then, if the project qualifies under a given approach, the credits that would be awarded to the project under the approach are estimated. Finally, the results of this analysis are subjected to a critique, in order to identify the strengths and weaknesses of each approach vis a vis the particular project.

Summary and Lessons Learned

Based on the detailed case studies, a number of main conclusions can be drawn, as follows:

- All of the project evaluation approaches demonstrate the capacity to misclassify free rider projects as additional (and vice versa). Often, these qualification errors differ among the approaches, making generalizations regarding project type difficult. However, in general, whereas the U.S. approach typically fails by qualifying free rider projects as additional, the EU and technology matrix approaches tend to fail by misclassifying truly additional projects as free riders. Also, the technology matrix approaches appear to result in the fewest qualification errors, although it is cautioned that this conclusion is based on an examination of hypothetical case studies that may not be representative of actual, future projects.

- Each of the four approaches encountered situations in which they simply could not be applied. The EU positive list encountered the most difficulties: seven case studies that simply could not be analyzed using the EU approach. This problem was found to arise from the vague, imprecise language used to define technologies within the positive list. The U.S. and technology matrix approaches also simply broke down in a number of cases. These failures manifest the need to include a backup methodology as an explicit default for *any* standardized, multi-project approach ultimately adopted. This back-up approach should be an ad hoc, non-standardized procedure that can be tailored to the characteristics of any particular project.

- Both the U.S. approach and the technology matrix approaches require the existence of facilities comparable to the project being assessed. The emissions data for these comparable facilities are used to benchmark the project. However, for some types of projects, and some countries, comparable facilities are likely to prove nonexistent. For example, this problem arose frequently for the countries of the FSU. Due to the long-term economic decline these countries have experienced, there is a dearth of recently built power plants and other facilities against which new projects can be compared. In addition to certain countries, the problem of nonexistent comparable facilities appears to plague certain sectors more often then others. For example, comparable facilities proved difficult or impossible to identify for a number of industrial sector case studies, due to the heterogeneous nature of projects in the industrial sector.

- The data required to perform the project analyses is, in many cases, likely to prove unavailable. Data availability will be a particular problem for the U.S. approach, because this approach requires the development of a percentile distribution of emission rate data for comparable facilities. The data requirements of the technology matrix approaches are less stringent, although even for these methods data availability is likely to prove a major problem for many developing country projects.

- The EU positive list is clearly less developed and well-defined than the other three approaches tested. A number of major problems arose from the application of the positive list to the case studies. First, the positive list lacks sufficient clarity in its definition of qualifying technologies and processes. Second, some projects were found to fit under more than one category on the list. The fact that a single project could potentially fall into two separate categories in the positive list, resulting in potentially conflicting qualification determinations, is clearly a fundamental internal inconsistency. Third, the EU approach fails to provide a procedure for quantifying the credits to be awarded to qualifying projects. Finally, the positive list focuses exclusively on energy-related projects, thereby automatically disqualifying whole classes of important projects. For example, the positive list automatically disqualifies projects aimed at reducing HFCs, PFCs and sulfur hexafluoride, despite the fact that these are very potent greenhouse gases.

- None of the four approaches provide adequate guidance for handling land use and forestry sector projects.

A number of recommendations were developed for addressing the above-noted problems and improving each of the four methods. In the case of the EU's positive list, improvements can be realized by (1) clarifying the definitions of qualifying technologies as well as quantifying qualification criteria; (2) developing a methodology for quantifying the number of credits to be awarded to qualifying projects; and (3) expanding the positive list to include non-energy, non-carbon related project opportunities. In the case of the U.S. approach, the distinction between new facility and retrofit projects needs to be clarified, and a backup additionality test that accounts for projects that fall outside the "efficiency and/or emission rate" box should be established. Finally, the two technology matrix approaches could be improved by strengthening the market penetration test to provide effective evaluation of first-of-its-kind projects, and explicitly addressing the treatment of multi-component projects that utilize advanced technologies for only some of the components.

Conclusions

The case study analyses indicate that, of the four approaches tested, the technology matrix provides the most stringent additionality test. Furthermore, the technology matrix offers several other advantages. First, it explicitly incorporates an alternative, project-specific backup methodology to be used in situations where the matrix does not apply or is unable to provide an accurate emission reduction estimate. Furthermore, the technology matrix is less data-intensive than the official U.S. approach. Finally, the technology matrix is technology neutral in the sense that it focuses on the additionality of the activities examined rather than relying on political processes to determine an emissions threshold or an acceptable technology.